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Spatial and temporal changes in the subtropical North Atlantic along 24.5ºN in terms of pH and other variables of the CO_2 system

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A large part of the CO_2 released to the atmosphere due to human activities is taken up by the oceans, raising the amount of total inorganic carbon dissolved in the upper layers, thus affecting the chemical balances of the CO_2 system in seawater. In addition to the estimation of the anthropogenic carbon inventory, establishing the rate at which ocean acidification is taking place is of crucial importance. The magnitude of this change is critical, for instance, to determine the fate of many marine ecosystems, particularly those that include calcifying species. Time series are the best tool to detect and quantify these changes in marine pH and to distinguish between the natural and anthropogenically derived variability.

Here we show data of spatial and temporal changes in the parameters of the CO_2 system in the subtropical North Atlantic Ocean, with a special focus on pH. We present the instrumental measurements that we performed in a transatlantic cruise along 24.5ºN in January-March 2011. This oceanographic section (WOCE A05) is of particular importance, amongst other reasons, because it is where the greater northward transport of heat and inorganic carbon takes place in the whole Atlantic Ocean. This explains why this section has already been repeated a number of times over the last 20 years, and offers the opportunity to place modern results on a historical perspective. In this context, we have compared our recent measurements with historical carbon data from the same section obtained in years 1992, 1998 and 2004 in order to evaluate the existence of any trends. To this end we divided longitudinally the whole basin in four regions to differentiate between eastern and western patterns and coastal or open-ocean regimes. In addition, we made a vertical division into six regions on the basis of the main water masses there present. Profiles and trends of pH and other parameters are shown for each of these regions and sections. Amongst other features, we find a common expected decrease in pH in the upper layers, which affects in particular the intermediate waters during the last decade. This general trend is more or less pronounced depending on each region of the basin, exhibiting a complex behaviour probably related with ocean circulation and possibly biological processes in these latitudes of the Atlantic Ocean.